

MC simulations for IceTop

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Outline

- CORSIKA settings used
- Weighting schemes
- Tank characteristics applied
- Triggering
- Rate Calculation
- Results

CORSIKA settings used

- Energy thresholds
 - Hadrons:
 - Muons:
 - Electrons:
 - Gamma:
- Magnetic fields
- Atmosphere

Number of events

Group	E_{\min}/GeV	Events	Group	E_{\min}/GeV	Events
0000	2.2×10^1	67320	8000	1.0×10^4	499000
1000	4.6×10^1	67320	9000	2.2×10^4	422400
2000	1.0×10^2	67320	10000	4.6×10^4	791
3000	2.2×10^2	67320	11000	1.0×10^5	500
4000	4.6×10^2	40000	12000	2.2×10^5	500
5000	1.0×10^3	40000	13000	4.6×10^5	401
6000	2.2×10^3	40000	14000	1.0×10^6	124
7000	4.6×10^3	40000	15000	2.2×10^6	143

Weighting schemes

$$\Phi = \Phi_0 \times \left(\frac{E}{E_0} \right)^{-\gamma}$$

- Generate with $\gamma' = 1.0$
- Simulate $\gamma = 2.76$

$$w = \Phi_{\min} \times \left(\frac{E}{E_{\min}} \right)^{-\gamma+\gamma'} \times \frac{n_{\text{bins}}}{n_{\text{Events}}}$$

Tank characteristics applied

Triggering

Done in stages:

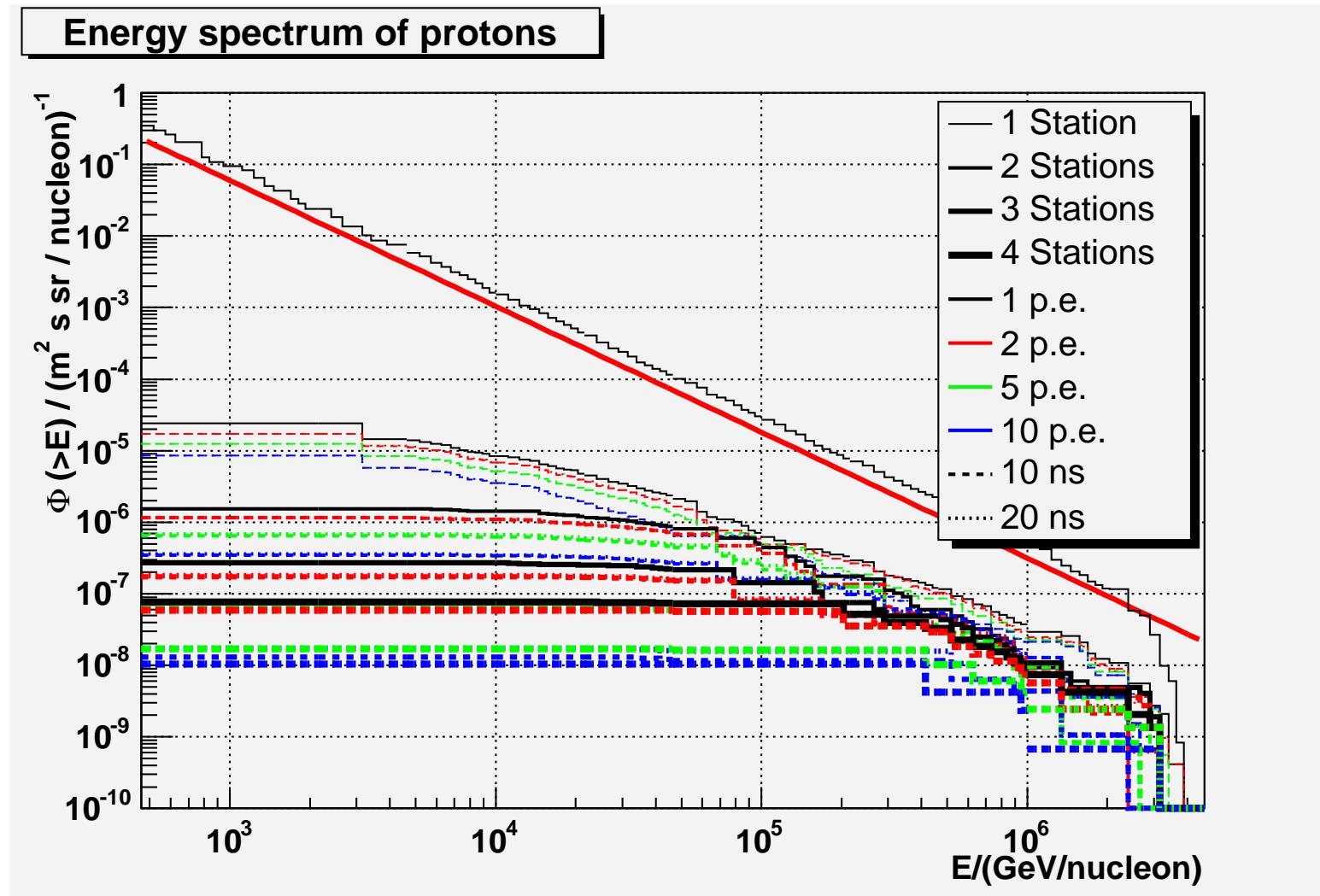
1. OM trigger: n p.e. within time window of Δt
2. Tank trigger: 1 OM per tank, second OM ignored
3. Station trigger: 2 tanks per station
4. Array trigger: 1, 2, 3, or four stations

Rate calculation

$$f(>E) = A \times \Omega \times \int_E^\infty dE' \Phi(E')$$

$$A = \pi(1000\text{m})^2 = 3.14 \times 10^6 \text{m}^2$$

$$\Omega = \pi(\cos^2(0.^{\circ}) - \cos^2(70.^{\circ}))$$



Results

OM threshold	f_1/Hz	f_2/Hz	f_3/Hz	f_4/Hz	f/Hz
1 p.e.	52.6	2.25	.59	.67	56.1
2 p.e./10 ns	37.4	1.67	.38	.51	40.0
5 p.e./10 ns	27.2	.93	.14	.15	28.4
10 p.e./10 ns	18.5	.51	2.85×10^{-2}	9.14×10^{-2}	19.1
2 p.e./20 ns	37.7	1.69	.39	.51	40.3
5 p.e./20 ns	27.4	1.00	.14	.15	28.7
10 p.e./20 ns	18.6	.52	3.75×10^{-2}	9.14×10^{-2}	19.2